(12) UK Patent Application (19) GB (11) 2 166 065 A

(43) Application published 30 Apr 1986

(21) Application No 8526492

(22) Date of filing 28 Oct 1985

(30) Priority data
(31) 8427240 (32) 27 Oct 1984 (33) GB

(71) Applicant
Webco Limited (United Kingdom),
Greenbank Place, Tullos, Aberdeen AB1 4BT, Scotland

(72) Inventor
George Andrew Webster

(74) Agent and/or Address for Service
Murgitroyd and Company,
49 Bath Street, Glasgow G2 2DL

(51) INT CL⁴
B05D 1/36 B32B 1/08 F16L 59/14

(52) Domestic classification
B2E 1710 409S 436U 464T 609U 614T M
F2P 1A35 1B7E C27
U1S 1405 1573 2316 3010 B2E F2P

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GB A 2097809 GB 1504645 GB 1394579
GB A 2081415 GB 1457955 GB 1046218
GB 1542333

(58) Field of search
B2E
B5A
F2P

(54) Insulated pipeline

(57) An insulated pipeline and a method of manufacturing it, the pipeline having around the pipe an inner coating of water-impermeable corrosion-resistant material and an outer jacket of heat-insulating protective material, whereby the pipeline is protected from heat loss, corrosion and mechanical damage. The coating and jacket are preferably flexible to facilitate laying of the insulated pipeline offshore.

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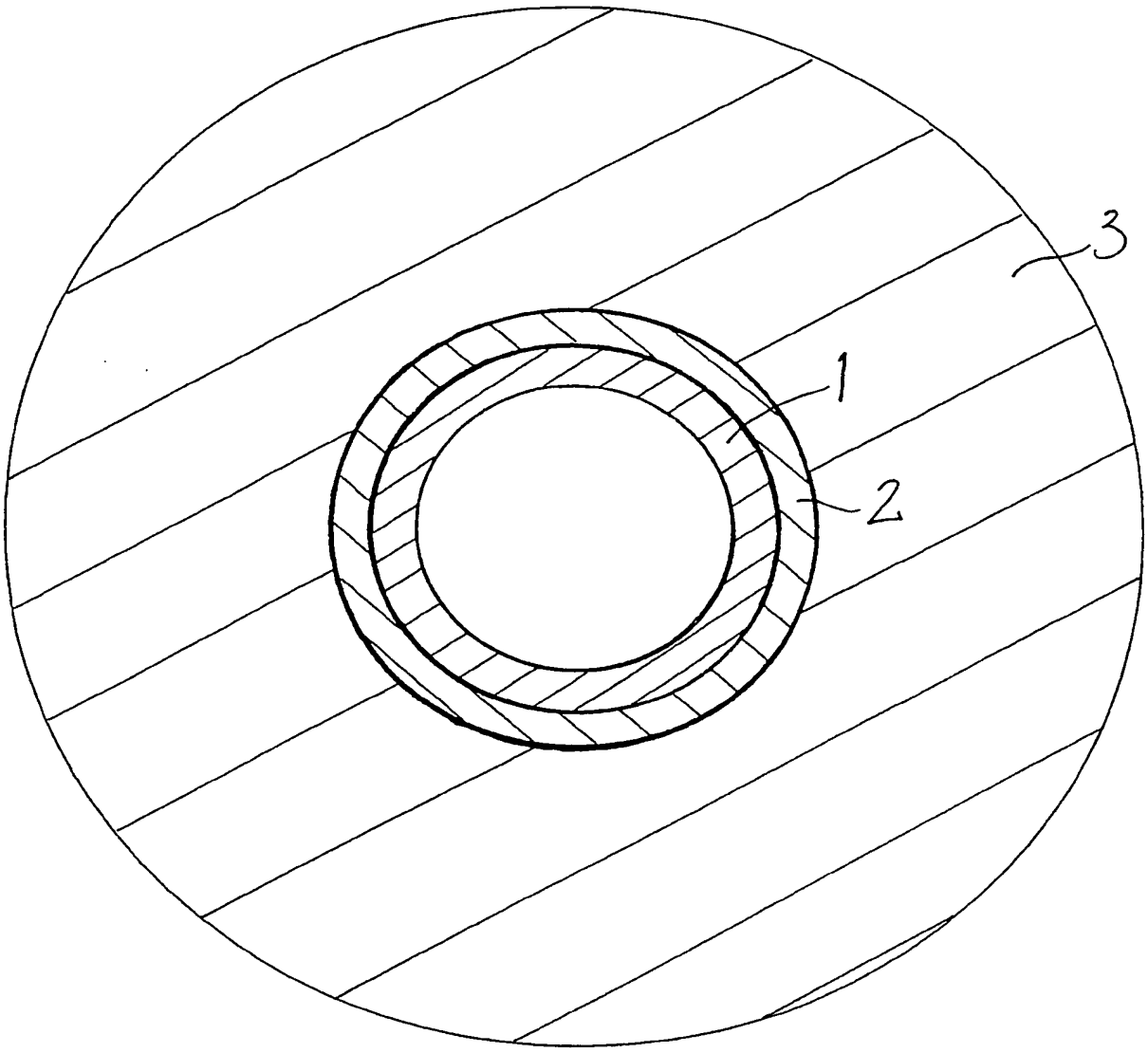
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SPECIFICATION

Insulated pipeline

This invention relates to an insulated pipeline.

Pipelines for passage of fluid along the sea bed for example require both heat insulation and protection against mechanical damage. Hitherto insulation has been provided by cellular insulating material such as expanded PVC, while an outer protective coating of non-cellular polyurethane provides impact and abrasion resistance.

Further, it has been proposed to provide a corrosion-resistant coating on the pipeline itself.

According to the present invention there is provided an insulated pipeline having a continuous corrosion-resistant coating on its outer face and a jacket around the corrosion-resistant coating in the form of a non-circular flexible protective material which is also heat-insulating.

Preferably the protective, heat-insulating jacket is from 25 to 75 mm in thickness. Preferably also it is bonded to the corrosion-resistant coating.

The protective jacket may be formed by providing a mould around the pipeline or a section of the pipeline which is pre-coated with the corrosion-resistant material, filling the space between the mould and the coated pipe with uncured non-solid material or mix, and curing the material or mix to form the jacket within the mould. The mould can then be removed.

The corrosion-resistant coating may be from 4 to 10 mm thick for best results, and can be applied to the pipeline for example by spraying, painting, winding or moulding.

An embodiment of the present invention will now be described by way of example with reference to the accompanying drawing which is an end sectional view of an insulated pipeline of this invention.

Referring to the drawing, the pipeline of this embodiment of the invention has a steel pipe 1 for carrying oil, the pipe to be laid in use on the sea bed. If the pipe 1 were not protected from corrosion it would rust, with eventual failure of the pipe wall, so a corrosion-resistant sealing layer 2 is applied to the pipe 1 so as to envelope completely the pipe outer face.

The layer 2 consists of 6mm thick polychloroprene rubber which is sold under the Trade Mark LINECOTE and is a flexible elastomer which is vulcanised and bonded to the pipe 1. The layer 2 provides a tough coating which is highly chemical and temperature resistant and impervious to moisture and sea water. It is also resistant to abrasion and has high tear and tensile strength, is highly resistant to ozone attack and flex cracking and has low temperature flexibility down to minus 30 degrees centigrade. It is resistant to oils, waxes and gases and most aliphatic hydrocarbons.

Around the corrosion-resistant layer 2 is a jacket 3 which provides both heat insulation and protection against mechanical damage. The jacket 2 consists of polyurethane which is 50 mm thick and which is based on a two-part polyurethane system having high abrasion and cut growth resistance, and excellent resistance to sea water. The physical properties of the material are as follows:

Hardness (IRHD)	84
Tensile strength (psi) min.	1850
Elongation at Break (%) min.	350
Tear Resistance (1b/inch) min.	200
Specific Gravity	1.13
Taber Abrasion Resistance Loss/1000 cycles (mg)	100
Compression Set at 70 degrees centigrade	40

Volume Swell in Sea Water Typical % Change

Temperature	*1 Week*	*2 Weeks*	*3 Weeks*
4 degrees centigrade	5.16	6.10	6.44
38 degrees centigrade	3.19	3.50	3.08
70 degrees centigrade	3.74	3.74	3.32

The insulated pipeline of this embodiment of the invention is manufactured by rotationally extruding the LINECOTE polychloroprene rubber onto the cleaned outer face of the pipe 1 to provide the layer 2. The rubber is applied in a manner which ensures that the pipe outer face is completely covered by the layer 2 thereby to protect it totally from its environment.

The outer face of the pipe 1 is pre-cleaned and prepared for coating by shotblasting to a minimum SA 2.5 and applying a primer under controlled temperature and humidity conditions.

After vulcanising the polychloroprene rubber in a steam autoclave at 153 degrees centigrade and 60 psi a 100% rubber tear bond is obtained (i.e. The strength of the chemical bond is greater than the tensile and tear strength of the rubber).

The jacket 3 is applied to the outer face of the corrosion-resistant layer 2 by first forming a mould (not shown) around the coated pipe 1 which defines a space between the layer 2 and the mould corresponding to the intended volume and shape of the jacket 3. Polyurethane to form the jacket 3 is then injected from a two-part polyurethane mixing machine into the mould and allowed to cure to form the flexible, non-cellular jacket 3. The mould is then removed, leaving the insulated pipeline in the form shown in the drawing.

The pipeline of this embodiment thus has a continuous, non-cellular, flexible, corrosion-resistant, abrasion-resistant and impact-resistant heat-insulating coating formed by the layer 2 and the jacket 3. The cost of providing heat insulation by mean of the non-cellular polyurethane jacket 3 is considerably less than a corresponding jacket of cellular PVC or the like and, while the insulating properties are not as great as with a cellular jacket, the pipeline of this invention will find application in environments where a moderate degree of insulation is adequate.

The flexible nature of the polyurethane jacket 3 allows the pipeline to be laid by reel barge, lay barge, "J-lay" or mid-depth tow without damage to the jacket, and this again is of advantageous over cellular jackets which tend to be rigid and liable to cracking and therefore require special construction or laying techniques.

Modifications and improvements may be made without departing from the scope of the invention.

CLAIMS

1. An insulated pipeline having a continuous corrosion-resistant water-impermeable coating on its outer face and a jacket around and in contact with the corrosion-resistant coating, the jacket being in the form of a non-cellular protective material which is also heat-insulating.

2. An insulated pipeline according to Claim 1, wherein the heat-insulating jacket is from 25 to 75 mm in thickness.

3. An insulated pipeline according to Claim 1 or 2, wherein the heat-insulating jacket is of polyurethane.

4. An insulated pipeline according to any one of the preceding Claims, wherein the heat-insulating jacket is flexible.

5. An insulated pipeline according to any one of the preceding Claims, wherein the heat-insulating jacket is bonded to the corrosion-resistant coating.

6. An insulated pipeline according to any one of the preceding Claims, wherein the corrosion-resistant coating is from 4 to 10 mm in thickness.

7. An insulated pipeline according to any one of the preceding Claims, wherein the corrosion-resistant coating is of polychloroprene.

8. An insulated pipeline according to any one of the preceding Claims, wherein the corrosion-resistant coating is flexible.

9. A method of manufacturing an insulated pipeline, comprising applying a continuous coating of corrosion-resistant water-impermeable material to a pipe, providing a mould around the coated pipe to define a space between the coating and the mould, introducing into the space uncured material which on curing provides non-cellular heat-insulating protective material, and curing the uncured material.

10. A method according to Claim 9, wherein the corrosion-resistant water-impermeable material is applied to the pipe by spraying, painting, winding or moulding.

11. A method of manufacturing an insulated pipeline substantially as hereinbefore described with reference to the accompanying drawing.

12. An insulated pipeline manufactured by the method according to any one of Claims 9, 10 and 11.

13. An insulated pipeline substantially as hereinbefore described with reference to and as shown in the accompanying drawing.

Printed in the United Kingdom for Her Majesty's Stationery Office, Dd 8818935, 1986, 4235.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.